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The growing season in England and Wales calculated from average 30 cm earth temperatures contained in MO 794

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Introduction

Although some grass growth occurs when mean soil temperatures are below 6°C , a considerable acceleration in the growth rate takes place as temperatures rise above this value (1). In comparing growing conditions at different sites it is convenient to define the growing season as the average period during which the 30 cm earth temperature is above 6°C (2). In practice the mean date of the start of spring growth is of much greater importance than is the date of the end of growth. In the spring light intensities are quite high at a time when low temperatures often limit growth, but in the late autumn and early winter light intensities are low and utilisation of any grass growth is difficult due to poaching problems. The length of the growing season has been calculated previously using 1921-50 averages (2), but starting dates were not given and there were very few sites in Wales or North-east England.

Data

In MO 794 average earth temperatures for the period 1931 to 1960 have been published. By linear interpolation between monthly means the average dates of the start and end of the growing season have been calculated, for each site in England and Wales. In certain areas (notably Wales) very few records of average earth temperatures for this period were available, but 30 cm earth temperatures have been recorded at a number of additional sites during the last 10 years. These have been compared with earth temperatures at long-period sites and estimates made of the equivalent 1931-60 averages. The data have been grouped into the climatological districts used in the "Monthly Weather Report", except for Wales which has been treated separately from southwest England and Northwest England (Figure 1). Appendix 1 gives the dates of the start and end of the growing season for each site. In the extreme southwest average temperatures at sea level were above 6°C in all months of the year giving an apparent average growing season of 365 days. This is clearly an overestimate of the true value as temperatures fall below 6°C in some winters.

Variation with height

Although soil type and exposure had a considerable effect on the mean temperatures, it was possible to calculate for each region (or part of a region) the mean variation with height of temperature in March and April, date of start of the growing season and date of end of the growing season. (Tables 1, 2, 3). Soil type appeared to cause greater site to site variability in the end of the growing season date which occurred during the period November to January. For example Swansea with a sandy soil had an earlier end of season date than did Cardiff with a clay soil although it was 54 m lower. Spring growth, however, started earlier at Swansea.

The average variation with height of the date of the end of the growing season was not well defined. In the spring, however, linear relationships could be obtained between the date of the start of the growing season and the height above mean sea level.

In the early spring the most rapid changes of temperature with height occurred in Southwest England and in south and west Wales. In these areas hilly or mountainous regions lie close to the sea and the mild coastal influence is confined to quite a small land area. The variation with height of about $1.2^{\circ}\text{C}/100\text{m}$ in March in the south and west and about $1^{\circ}\text{C}/100\text{m}$ in April throughout England and Wales was considerably greater than the mean lapse rate usually applied to air temperatures i.e. $0.6^{\circ}\text{C}/100\text{m}$.

The height range of the observations in Wales was from sea-level to 400 m and the variation with height of 14 days/100 m in the start of the growing season is probably only applicable to that range.

Mean date of start of growth

Figure 2 shows the mean dates of the start of the growing season in England and Wales. Isopleths generally followed the contour lines. It is interesting to note that over most of Southeast England, Eastern England, the Midlands, Lancashire and Cheshire the mean date was about 20 March.

Table 2 may be used to calculate the average date of the start of spring growth at a given site using the mean sea level value appropriate to the area and applying an altitude correction. These dates do not take into account soil type and exposure, but provide a general guide as to the relative earliness of different sites.

Mean date of end of growth

As a first approximation this date can be obtained from Table 3, but site and soil factors can modify it considerably.

Differences between the periods 1921-50 and 1931-60

In MO 794 comparisons have been made between the 1921-50 and the 1931-60 normals. As far as the length of the growing season is concerned the most significant differences occurred in November and December when mean earth temperatures were up to 0.6°C higher during the later period. March mean earth temperatures were almost the same for both periods while those for April were about 0.1°C to 0.2°C higher in 1931 to 1960. The mean date of the start of the growing season was almost identical for both periods but that for the end was approximately 6 days later in the 1931 to 1960 period.

References

- (1) M G Roy and J M Peacock, 1971. Seasonal forecasting of the spring growth and flowering of forage crops in the British Isles.
Meteorological Office, Agric. Memo. No 372.
- (2) L P Smith 1963. Earth temperatures and the growing season.
Meteorological Office, Agric. Memo. No 81.

Any comments or suggestions on this paper should be referred to the author.

Meteorological Office
Bracknell

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TABLE 1

Earth temperatures at 30 cm in March and April

Mean decrease of temperature with height in °C/100 m

<u>Region</u>	<u>March</u>	<u>April</u>
<u>SW England</u>		
Devon, Cornwall	1.2°C	1.2°C
Somerset, Dorset	1.2°C	1.1°C
<u>SE England</u>	1.1°C	1.2°C
<u>E England, Midlands</u>	0.6°C	0.8°C
<u>Wales</u>		
W coast	1.0°C	1.0°C
E Wales	0.5°C	0.8°C
<u>NW England</u>	0.8°C	1.0°C
<u>NE England</u>	0.7°C	0.8°C

TABLE 2

Date of start of growing season at MSL and number of days variation with height using mean date when mean earth temperature reaches 6°C (42.8°F).

Region	Date at mean sea-level	mean correction with height days/100 m
<u>SW England</u>		
Cornwall and Devon	Not defined	17
Somerset and Dorset	3 March	14
<u>SE England</u>	5 March in Hampshire becoming 12 March in N Kent	14
<u>Midlands and E England</u>	15 March in south Midlands and E England becoming 25 March in W Riding of Yorkshire	11
<u>Wales</u>		
West and south coasts	Before 28 February	14
East and central Wales	10 March in south becoming 20 March in north	9
<u>NW England</u>	20 March in south becoming 25 March in north	9
<u>NE England</u>	20 March in Lincolnshire becoming 30 March in Northumberland	8

TABLE 3

Date of end of growing season at MSL and number of days variation with height using mean date when earth temperature falls below 6°C

Region	Date at mean sea-level	Mean correction with height days/100 m
<u>SW England</u>		
Cornwall and Devon	Not defined	-14
Somerset and Dorset	25 December	-14
<u>SE England</u>	25 December in Hampshire becoming 15 December in N Kent	-14
<u>Midlands and E England</u>	10 December	-10
<u>Wales</u>		
West and south coasts	3 January in southwest and west becoming 20 December in southeast	-11
East and central Wales	15 December	-10
<u>NW England</u>	15 December in south becoming 10 December in north	-10
<u>NE England</u>	10 December in Lincolnshire becoming 1 December in Northumberland	- 8

APPENDIX I

Start and end of growing season interpolated from 1931-60 averages of 30 cm earth temperatures.

Southwest England

Site	height above MSL (metres)	start of growing season	end of growing season	length of growing season
Camborne	76	20 Feb	5 Feb	350
Falmouth	51	N O T D E F I N E D		365
Ilfracombe	8	20 Feb	15 Jan	329
Long Ashton	49	10 March	20 Dec	285
Plymouth	36	25 Feb	15 Jan	324
Totnes	37	25 Feb	5 Jan	314
Bath	118	10 March	15 Dec	280
Nettlecombe	96	15 March	12 Dec	272
Cannington	29	27 Feb	1 Jan	307
Cheddar	11	7 March	14 Dec	282
Cheldon Barton	163	17 March	8 Dec	266
Poole	8	7 March	14 Dec	282
Starcross	9	27 Feb	17 Dec	293

Southeast England

Site	height above MSL (metres)	Start of growing season	end of growing season	length of growing season
Bexhill	4	1 March	25 Dec	300
Bodiam	22	15 March	15 Dec	275
Bournemouth	42	15 March	20 Dec	280
Dover	6	10 March	25 Dec	290
Eastbourne	7	5 March	1 Jan	302
Hastings	45	10 March	10 Dec	275
Hurley	43	20 March	1 Dec	256
Kew	5	15 March	25 Dec	285
Leckford	117	25 March	5 Dec	255
Kensington Palace	24	15 March	15 Dec	275
Margate	15	10 March	20 Dec	285
Marlborough	129	20 March	5 Dec	260
Porton	111	20 March	5 Dec	260
Reading	45	15 March	10 Dec	270
Sittingbourne	68	20 March	10 Dec	265
Southgate	67	20 March	15 Dec	270
Southsea	2	5 March	25 Dec	295
Swanley	54	20 March	15 Dec	270
Tunbridge Wells	107	20 March	1 Dec	256
Ventnor Park	60	5 March	1 Jan	302

East England

Site	height above MSL (metres)	start of growing season	end of growing season	length of growing season
Cambridge	13	20 March	5 Dec	260
Clacton on Sea	16	15 March	10 Dec	270
Earls Colne	49	20 March	10 Dec	265
Gorleston	0	15 March	15 Dec	275
Ipswich	38	25 March	10 Dec	260
Lowestoft	25	20 March	5 Dec	260
Luton	115	25 March	5 Dec	255
Rothamsted	128	25 March	1 Dec	251
Silsoe	59	20 March	5 Dec	260
St Albans	83	25 March	1 Dec	254
Terrington	4	20 March	10 Dec	265
St Clement				
Woburn	89	25 March	5 Dec	255

Midlands

Site	height above MSL (metres)	start of growing season	end of growing season	length of growing season
Bradford	134	5 April	20 Nov	229
Buxton	307	15 April	15 Nov	214
Cawood	6	25 March	25 Nov	245
Coventry	103	25 March	5 Dec	255
Edgebaston	163	1 April	1 Dec	244
Halesowen	154	25 March	1 Dec	251
Huddersfield (Oakes)	232	5 April	20 Nov	229
Huddersfield (Ravensknowle)	99	5 April	25 Nov	234
Keele	179	5 April	25 Nov	234
Malham Tam	395	15 April	20 Nov	219
Malvern	62	20 March	20 Dec	275
Nottingham	59	1 April	25 Nov	238
Oaken	125	1 April	1 Dec	244
Oxford	63	20 March	5 Dec	260
Raunds	59	20 March	1 Dec	256
Ross on Wye	68	15 March	10 Dec	270
Rugby	117	25 March	25 Nov	245
Sheffield	131	1 April	25 Nov	238
Shipston-on-Stour	111	25 March	10 Dec	260
Shrewsbury	56	20 March	10 Dec	265
Sutton	48	1 April	10 Dec	253
Bonington				
Wakefield	37	1 April	5 Dec	248
Wellesbourne	47	25 March	25 Nov	245

Northwest England

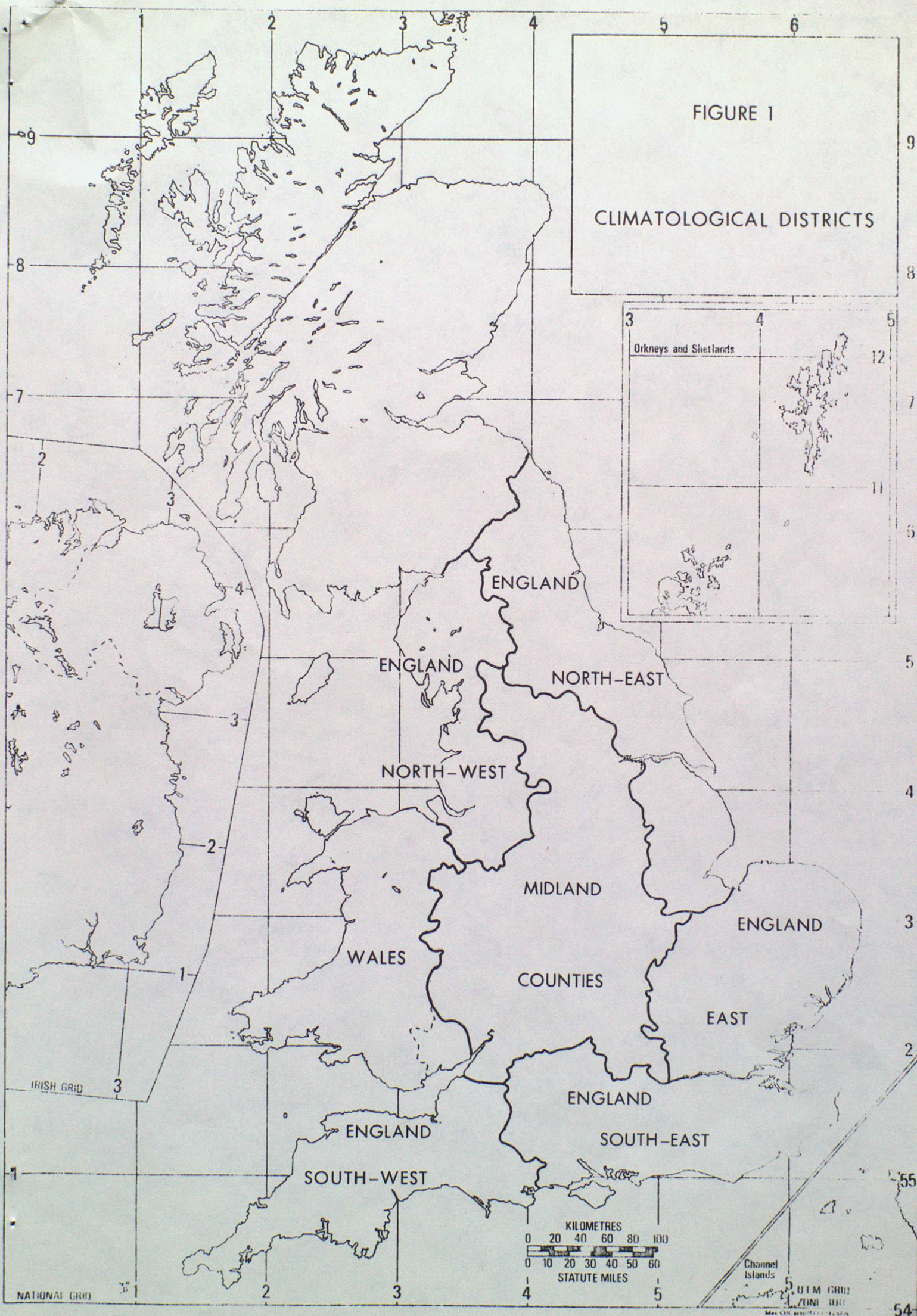
Site	height above MSL (metres)	start of growing season	end of growing season	length of growing season
Hawarden	5	20 March	5 Dec	260
Helmsshore	260	5 April	25 Nov	234
Keswick	77	1 April	5 Dec	249
Moor House	556	5 May	1 Nov	179
Nelson	165	5 April	20 Nov	229
Spadeadam	274	20 April	5 Nov	199
Southport	5	25 March	25 Nov	245
Newton Rigg	171	10 April	15 Nov	219
Knutsford	65	30 March	28 Nov	243

Northeast England

Site	height above MSL (metres)	start of growing season	end of growing season	length of growing season
Cockle Park	99	5 April	10 Nov	219
Cranwell	63	25 March	5 Dec	255
Durham	102	1 April	25 Nov	238
High Mowthorpe	175	10 April	20 Nov	224
Hull	2	25 March	1 Dec	251
Kielder Castle	201	10 April	15 Nov	219
Lincoln	14	25 March	1 Dec	251

Wales

Site	height above MSL (metres)	start of growing season	end of growing season	length of growing season
Swansea	8	5 March	15 Dec	285
Cardiff	62	15 March	18 Dec	278
Carmarthen	15	28 Feb	2 Jan	308
Dale Fort	33	25 Feb	15 Jan	324
Llandrindod	235	28 March	12 Dec	259
Wells				
Lake	303	13 April	28 Nov	229
Vyrnwy				
Botwnnog	34	2 March	28 Dec	301
Cwm Dyli	99	25 March	16 Dec	266
Loggerheads	210	7 April	25 Nov	232
Colwyn Bay	36	17 March	29 Dec	287
Wrexham	84	28 March	1 Dec	254
Bwlchgwyn	386	16 April	18 Nov	216



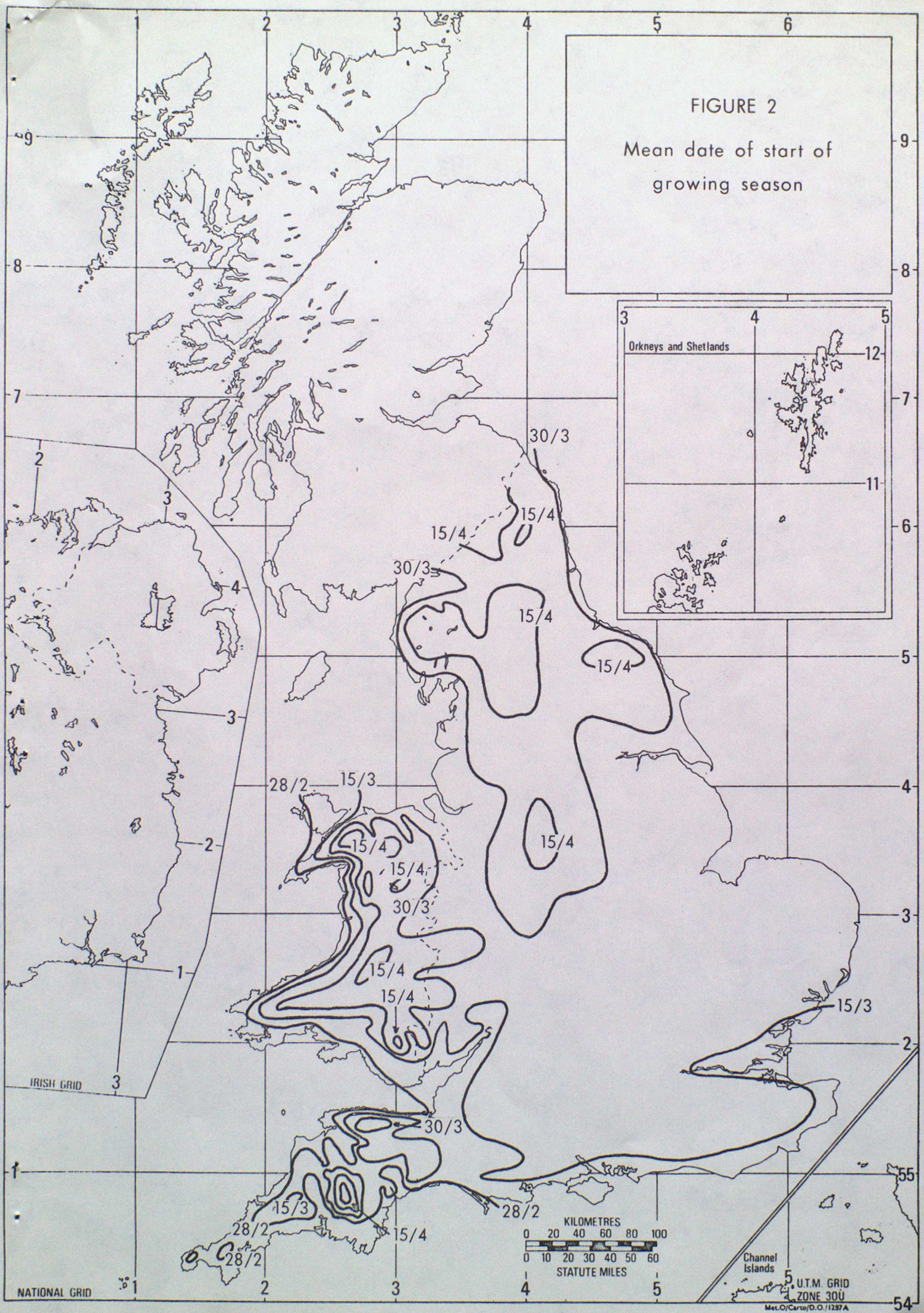


FIGURE 2

Mean date of start of growing season

Orkneys and Shetlands

IRISH GRID

NATIONAL GRID

KILOMETRES
0 20 40 60 80 100
STATUTE MILES
0 10 20 30 40 50 60

Channel Islands
5. U.T.M. GRID
ZONE 30U
Met.O./Carroy/D.O./1297A